DOCUMENT RESUME

ED 411 800 IR 056 624

AUTHOR	Crotts, Joe
TITLE	Subject Usage and Funding of Library Monographs: A Case Study.
PUB DATE	1997-00-00
NOTE	51p.
PUB TYPE	Reports - Research (143)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Case Studies; Higher Education; *Library Circulation; Library Expenditures; *Library Funding; *Library Materials; Library Personnel; Library Statistics; *Resource Allocation; *User Needs (Information)
IDENTIFIERS	*California State University Chico; *Monographs

ABSTRACT

The goals of this study were to identify those variables that prove indicative of the relative demand for library monographs by subject and to develop a practical method for allocating funding by subject. California State University, Chico, served as the sample for the study; data was collected from the 5-year period from 1990 to 1995. The interrelationships among circulation, expenditure, enrollment, number of faculty, book price, and new books acquired are investigated. Circulation is isolated as the one tangible parameter upon which to measure the demand for books by subject. A model for allocating subject funding is developed. Twenty-five figures and tables show statistics. (Contains 17 references.) (Author/AEF)

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SUBJECT USAGE AND FUNDING OF LIBRARY MONOGRAPHS

A Case Study

1997

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SUBJECT USAGE AND FUNDING OF LIBRARY MONOGRAPHS

A Case Study

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I. Abstract

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A Case Study

Abstract

The goals of the study are to identify those variables that prove indicative of the relative demand for monographs by subject and to develop a practical method for allocating funding by subject. The interrelationships among circulation, expenditure, enrollment, number of faculty, book price, and new books acquired are investigated. Circulation is isolated as the one tangible parameter upon which to measure the demand for books by subject. A model for allocating subject funding is developed.

II. Text

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SUBJECT USAGE AND FUNDING OF LIBRARY MONOGRAPHS

A Case Study

A good formula would help guarantee that available book funds will be distributed efficiently and equitably, that departments will be properly funded... [1].

Background

Academic libraries experienced a proliferation of new periodicals accompanied by radically escalating subscription rates throughout the 1980's and into the early 1990's. Institutions responded from within by conducting intensive assessments of periodical usage and expenditure, subsequently proceeding to massive cancellations. The publishing industry, albeit slow to realize the definitiveness of the library dollar, is responding by repackaging periodical literature into electronic formats. The literature is replete with survey techniques and formulae for assessing usage of periodical titles by subject and, correspondingly, the allocation of monies by subject for periodicals.

Resolving what appeared to entail an insurmountable task several years ago, appears, today, more manageable as a desirable by-product of the massive transition of periodical literature into electronic format and subsequent networking into comprehensive, multititle and multidisciplinary, partial and full text CD ROM and, increasingly, online electronic resources. Technology, thank you!

Monographs, however, have not received such favorable acceptance by the new technology. Electronic packaging has been slow to emerge, and, predictably, the *book,* in its present physical form, will remain the mainstay of academic library collections for the remainder of the 20th Century. "On the whole ... current books are simply not now available electronically. Nor will see all the titles already in print on line someday....we are still not even close to having the critical mass of information available on line that is necessary to support faculty or even student research [2]."

Major funding outlay for monographs will continue to encumber large portions of collection budgets. With escalating monograph prices exceeded only by the continued shrinkage of the library book budget, and both topping the rate of inflation, it becomes increasingly imperative that every dollar expended be directed at ensuring maximum return as a *resource in demand.*

The State of Research

Random chaos beneath a seemingly logical surface (Kurt Vonnegut).

Unfortunately, empirical investigation into technique and formulae for assessing subject usage and allocating monies for monograph collection development has lagged far behind similar emphases placed upon periodical literature. Tradition remains prevalent. The time honored practice of allocating monies in relative proportion to academic department size, measured almost invariably in terms of *faculty number*, continues to dominant methodology for determining department "book budgets." Ostensibly, departments with more numerous faculty receive larger allocations. This single factor overwhelmingly predominates over all other and related criteria, and has seldom undergone serious challenge. The substitution of *subject circulation,* a variable of significantly greater consequence, has received only minimal acceptance as the primary weighted factor in determining departmental monograph allocations.

Departmental allocations for monographs almost invariably reflect *anticipated* behavior. We presume that a department with a large number of faculty has achieved that magnitude in response to supporting a large number of students, who will, in turn, place a correspondingly and proportionately heavy demand upon the monograph collection.

The expenditure of these funds, however, should ideally reflect *actual* behavior. "Seldom does anticipated match actual behavior in a complex social structure, and the academic library is no exception" [3]. "One must consider a number of factors such as past practices, differential publication and inflation rates, level of demand, and actual use" [4]. And here lies the crux of the matter. The *level of demand*, best reflected as a measure of actual usage of materials, is all too frequently a poor indicator of department size. A large department may *not* generate heavy library usage. Conversely, smaller departments *may well* generate heavy library usage. Consequently, tradition in practice does not uniformly hold true in application. Ignored, as is all to often the case, it takes the effect of large allocations being assigned to some large departments which generate relatively little demand upon monographic usage. Conversely, small departments generating intense monographic usage may receive small allocations for which to purchase what inevitably become resources in very high demand.

Previous attempts to quantify the demand for monographs in differing subjects have relied heavily upon the inclusion of artificially (qualitatively) derived weighted factors designed to introduce a measure of "hardness" to the intellectual organization and content of the subject [5]. Similar attempts have incorporated preconceived notions of thresholds and optimal magnitudes of total monographs or monographs per student [6] and the assignment of variables of arbitrary weights derived from "judgment based on experience and the librarian's own knowledge of his [or her] own

library" [7]. Such variables tend to drive the formula toward nonstatistically supported results rather than support an accurate representation of actual usage of monographs by subject. These and related nonstatistically derived variables have tended to weigh heavily (if not disproportionately heavily) in calculations, and have thus rendered formulae for determining subject allocations to poorly reflect what they probably should most be indicative of: actual usage of materials.

Resolving the issue entails one to inquire, how can actual behavior (monographic usage) be predicted in terms sufficiently accurate to exert an equitable influence over magnitude of departmental monograph allocations? Simply put, *how can we better measure usage; so we can better determine departmental book budgets?*

"One might expect that ... [over] the many years ... librarians would have made considerable progress in defining the values, methods, scope, and the purposes of collection evaluation. But such is not the case" [8]. Twenty variables with potential and probable consequence in collection evaluation were identified in 1941 [9]. Subsequent efforts directed at relating selected individual and groups of these variables to derive meaningful and practical methods of collection evaluation have met with little success and received sporadic acceptance at best. Results tend to be decidedly inconclusive. "No formulas, magic or otherwise, result..." [10]. "...the attempt to identify and weigh the factors which affect the need for books in academic situations reveals gaps in our knowledge, to the filling of which research might profitably be directed. The difficulty arises simply from the quantity of detail and number of variables involved..." [11].

Achieving a viable solution to these problems eludes practitioners to this very day. "Clearly libraries support a large base of users... . How then is it possible to know when collections are at least adequate to meet campus needs? By what criteria might librarians determine the adequacy of the collections they are responsible for building in relation to the audience that the collection is to support?" [12].

Goal and Objectives of the Study

The goals of the study are to identify those variables that may serve to reflect the relative demand for monographs by subject and to develop a practical method for allocating funding by subject. Proceeding upon the premise that the "pot" of money at one's disposal is finite in the sense that an overall total applies collectively to all subjects, the solution entails determining the relative proportion of funding appropriate to each subject.

Objectives of the Study

The overriding objectives of this study are:

B. to develop a better technique for predicting usage of the monograph collection and, correspondingly, for formulating the allocation of monies for monographs in different subject areas.

Issues to be addressed include:

A. Who is using the collection;
B. How does current usage reflect expenditure by subject;
C. How does current usage reflect enrollment by subject

The Study Site

California State University, Chico, served as the sample for the study. The university enrolls approximately 12000 students. Undergraduate degrees are offered in 57 disciplines, including most areas of the humanities, social sciences, engineering, and technology. Masters degrees are offered in 29 of these disciplines. The campus is largely residential and is the only comprehensive institution of higher education in a vast rural area. Students and faculty depend entirely upon the resources of the university library, as no other comprehensive academic or public libraries are located within a hundred mile radius.

The Data

Data was collected from the five year period from 1990 to 1995. Annual averages were calcuated and manipulated in the analyses.
Individual subjects, generally, but not exclusively, corresponding to academic departments, serve as the basic unit upon which data is organized. Three subjects, Medicine, Architecture and Photography, in which the university does not offer degrees, were included in analyses not involving enrollment.

The analysis centers upon the interrelationships of this *subject data.* Components of subject data used in the analysis include expenditure, enrollment, circulation, faculty number, book prices, and number of new books. Enrollment is reported in terms of "FTE" (full time enrolled student); i.e., the total units (hours) divided by 15. Subject expenditure includes the "departmental" allocation together with expenditure encumbered by books received though the approval plan. Circulation includes initial checkouts and renewals.

Analysis of the Data

EXPENDITURE

Expenditure and Enrollment

The relationship between enrollment and expenditure exhibits a broad range of variation (Figures 1, 2). Enrollment in approximately 30% of departments is proportionate to expenditure. These "proportionate"

departments range from large to small. Wide variation exists among the remaining departments to the extent that no generalizations can be drawn. In fact, it cannot be said that the largest departments in terms of enrollment consistently reflect higher expenditures; nor do smaller departments consistently reflect smaller expenditures.

Expenditure and enrollment are not proportionately related. Enrollment cannot be used as an indicator of expenditure.

Expenditure and Faculty

The relationship between number of faculty and expenditure exhibits a pattern similar to that of enrollment and expenditure; i.e., a very broad range of variation (Figure 3).

Expenditure and faculty number are not proportionately related.

The number of faculty cannot be used as an indicator of expenditure.

Expenditure and Book Price

The relationship betweeen book prices and expenditure is characterized by two very diametrical trends reflecting a suprisingly strong negative correlation (Figure 4). Subjects with low average book prices tend to exhibit high expenditures; whereas, subjects with high average book prices tend toward low expenditures. The logical and popular notion that expenditure for books in a subject will proportionately reflect, at least in part, the average cost of books in that subject, is not evidenced for most subjects. If anything, the opposite appears to prevail. With increasing average book prices by subject, a strong tendency prevails toward decreasing expenditure.

Book prices tend to be inversely related to expenditure.

The data fails to support any indication that expenditure is systematically related to enrollment or faculty number. An obvious inverse relationship exists between expenditure and book prices; however, the wide range of variation precludes a well defined trend.

Neither enrollment, number of faculty, nor average book prices in subjects can serve as a reliable standard upon which to base the allocation of funding by subject.

CIRCULATION

The circulation parameter is paramount, in that here the *actual use* of the collection is measured as opposed to *potential* and *probable* use in terms of enrollment, faculty number, and book prices.

Circulation and Expenditure

Expenditure and circulation of books by subject show a fairly positive correlation for most of the humanities and social science (Figure 5). The physical sciences and business, however, skew the pattern significantly with strong negative correlations. In general, business and most physical sciences show circulation much lower than the relative expenditure for books in these subjects. Overall, the variation exceeds the range that would allow for formulation of a meaningful equation to define the relationship between circulation and expenditure by subject, although a definite pattern is apparent toward increasing circulation with increasing expenditure (Figure 6).

In highly generalized terms, circulation may be defined as a function of expenditure through the equation:

$$C = 0.6E - 3000$$

where: C = circulation
E = expenditure (in dollars)

The coefficient must be adjusted upward for subjects having high circulation relative to expenditure and adjusted downward for subjects having low circulation. The wide variation in the coefficient necessary to make the equation valid severely limits its practical value.
Consequently, *expenditure cannot be used as an accurate guage of circulation. However, in a very general sense, circulation tends to increase with increasing expenditure.*

Circulation and Enrollment

The relationship between enrollment and circulation does not exhibit a well defined pattern (Figure 7). Higher enrollment does not necessarily generate higher circulation; not does the opposite prevail. Exceptions run the full range of subjects and are too numerous to allow for other than the broadest of generalizations to be made. The majority of circulation is generated by the medium sized departments and English, the largest department. Business areas exhibit very low circulation in relation to enrollment; whereas, religion, economics and art show very high circulations. No commonality applies to the sciences and technology. Circulation in engineering is disportionately high; mathematics is very low; whereas biology is proportionate to its enrollment.

Rather than a distinct linear trend, the data displays a pyramidal pattern with higher circulations concentrated among the medium sized departments (Figure 8) and decreasing as enrollent decreases and increases.

Circulation is not proportionate to enrollment.
Enrollment cannot be considered a functional paramter in guaging circulation.

Circulation and Faculty

The number of faculty in each subject has very little influence upon circulation (Figure 9). The relationship between faculty and circulation is very similar to that of enrollment and circulation (Figure 7).

Circulation and faculty number are not proportionately related.

Circulation Per Capita
Per capita circulation ranges from 51 to less than 0.5 books per student per year (Table 1). The average is 13.0 and closely approximates the median of 10.1. Engineering and computer science/engineering join subjects in the humanities and social sciences in having per capita circulation well above the average. Business areas exhibit very low per capita circulation, along with mathematics/statistics, nursing, chemistry and construction management. The very low value for English reflects the large number of entry level classes in relation to middle and upper level courses in that subject.

Circulation Per Capita and Expenditure
The relationship between circulation per capita and expenditure exhibits a broad range of variation (Figure 10) and differs little from that of gross circulation in its relationship to expenditure (Figure 5), with the exception of English. The message presented by the data is clear: *higher book budgets do not uniformly generate higher circulation.*

Expenditure Per Capita
Per capita expenditure ranges from 100 to 7 dollars per student and is fairly evenly distributed across the full range of values (Figure 11). The average of 34.3 is skewed upward and well above the median of 25.6 by abnormally high values for Theater Arts and Art. Per capita expenditure for 31% of subjects falls below the average. No collective patterns among related subjects are prevalent in the hierarchy of per capita expenditure. Subjects distributed among the humanities, social sciences, physical sciences and technology run the full range of values.

Circulation Per Capita and Expenditure Per Capita
In general, higher per capita expenditure reflects higher per capita circulation (Figure 11). However, exceptions are too numerous to allow for a well defined trend to define the relationship.

Higher Per capita expenditure does not uniformly reflect higher per capita circulation.

Circulation Percentage and Expenditure Percentage

The relationship between percentage of expenditure by subject and percentage of circulation by subject exhibits greater proportionality and uniformity than prevails in related correlations (Figure 12). Approximately 50% of subjects reflect circulations proportionate to their share of expenditure. Business and the sciences display disproportionately low circulations; whereas, Recreation, Physical Education, Computer Science and Communications show very high circulations relative to their share of expenditure.

The ratio of expenditure percentage to circulation percentage ranges from 3.0 to 0.1 (Table 2). The average is 1.0, and, with the exception of an inordinately high value for recreation, values range quite uniformly across the full scale. High ratios indicate that circulation in those subjects exceeds the relative amount of funding allocated to those subjects for book purchasing; whereas, low ratios indicate that circulation in those subjects falls below relative funding.

The correlation between expenditure percentage and circulation percentage exhibits a loose but definite trend toward increasing circulation with increasing expenditure (Figure 13). The distribution of values allows for a highly generalized equation to describe the relationship:

$C = (1.8E) - 1$

where: C = circulation percentage
E = expenditure percentage

Therefore, taking the known expenditure percentage, the circulation percentage can be predicted. The equation proves quite valid for subjects with lower expenditures. With increasing expenditure, the equation becomes less applicable, as circulation percentage tends to lag.

Enrollment Percentage and Circulation Percentage

The relationship between enrollment percentage and circulation percentage (Figure 14) exhibits much greater extremes than that of expenditure and circulation (Figure 12. Less than 30% of subjects reflect circulations proportionate to their share of enrollment. Extreme variation characterizes much of the remainder. The business areas, mathematics and, surprisingly, political science, have very low circulation. The remaining sciences tend toward proportionality in circulation. Several subjects in the humanities and social sciences, along with engineering, have very high circulation in relation to their enrollment.

The percentage of enrollment cannot be used as an indicator of circulation.

Circulation and New Books

The relationship between the number of new books acquired and circulation is fairly uniform and evenly distributed among subjects ranging from small to large (Figure 15). Circulation is proportionate to new books acquired in almost 70% of subjects. Business areas and Theater Arts are major exceptions, showing very low circulation; whereas, education, medicine, recreation and computer science show very high circulation. Circulation by subject tends to increase with increases in the number of new books in those subjects added to the collection (Figure 16). The correlation may be loosely defined by the equation

$C = 20B$

where: C = circulation
B = new books

Consequently, circulation may be predicted from the number of new books acquired.

The number of new books is positively related to circulation for most subjects.

Circulation and Book Prices

The relationship between book prices and circulation exhibits a fairly uniform negative correlation (Figure 17) and is quite similar to the relationship of book prices to expenditure (Figure 4). Subjects in which average book prices are high have low circulations; whereas, "low cost" subjects have high circulations. Disparities tend toward the extreme, expecially among the most and least expensive subjects (note the top and bottom four subjects in book price).

With a few exceptions, the trend clearly indicates that expensive books circulate little; whereas, lower priced books circulate heavily (Figure 18). In terms of total dollars expended, 62% of the total allocation purchases books in subjects at or below the average book price of $55.00, which generates 70% of total circulation. Three subjects, History, English and Sociology, generate 30% of overall circulation, but with low book prices collectively averaging only $38 per book, encumber only 20% of total expenditure. On the other hand, the three subjects at the top of the price list, chemistry, biology and physics, generate only 4% of overall circulation, but with book prices collectively averaging a very high $121 per book, encumber 12% of total expenditure.

Book prices are inversely related to circulation.
Expensive books do not tend to circulate more than "cheap" books; in fact, the opposite prevails. Lower priced books tend to circulate more than expensive books.

Book Prices and Circulation Per Capita

The trend in circulation per capita related to book prices (Figure 19) closely reflects that of gross circulation to book prices (Figure 17). The similarity in these two correlations effectively reduces the weight of subject enrollment as a serious factor in the relationship of circulation to book price and increases the weight of per capita circulation of books by students (presumably for the most part) enrolled in those subjects. High circulations primarily reflect a high number of books in these subjects checked out by each (or most) students enrolled in these subjects. Heavily enrolled subjects, such as history, do not owe their high circulations entirely to high enrollment, but equally or more to very high per capita circulation (51.3 for history) by students enrolled in those subjects. Conversely, Finance, another subject with very high enrollment, has a very low circulation, and correspondingly, a very low per capita circulation (1.3). The major exception is English, where an extremely large lower level enrollment generates a high gross circulation but a low per capita circulation.

Circulation per capita is inversely related to book prices, being highest among subjects characterized by lower priced books.

Circulation per capita contributes more than enrollment to circulation.

The "Cost" of Circulation

The *cost* of circulation can be measured in terms of ratios between expenditure for books and number of books circulated. Values can be measured in terms of the amount of money spent for each book circulated (dollars/book) and, conversely, the number of books circulated for each dollar expended (books/dollar) (Table 3). The values represent a tangible indication of *return on the dollar* for usage of books by subject. Cost in terms of dollars per book averages $4.49 and ranges from a low of $0.71 for Recreation to a high of $24.90 for Accounting. Values increase quite uniformly, with the exception of extremely large increases for the three most "expensive" subjects, Finance, Chemistry and Accounting. Excluding these three subjects, the average falls to $3.26. The overall median is only $2.67.

A similar pattern in reverse prevails for the number of books circulated for each dollar in expenditure. Values in terms of books circulated per dollar average 0.41, and range from a high of 1.41 for Recreation to a low of 0.0.4 for Accounting. Values decrease quite uniformly throughout the range.

The most expensive subjects to circulate fall primarily within the sciences, business, and technology, with the notable inclusion of theater arts. The less expensive subjects include a combination of social sciences, humanities, medicine and computer science.

The cost of circulation falls below the overall average of $4.49 for 71% of subjects. 54% of subjects fall below $3.00 per book, with the largest group of subjects (31%) circulating within the one dollar range and below.

The cost of circulation for books in the majority of subjects falls below $3.00 per book, and well below the average of $4.49.

In terms of *number* of books circulated:

90% circulated at costs below $4.00 per book;
80% circulated at costs below $ 3.00 per book;
55% circulated at costs below $ 2.00 per book.

Books circulating at costs exceeding $4.00 per book comprised only 10% of overall circulation, and primarily included books in sciences and business.

The vast majority of books circulate at cost below $3.00 per book.
The majority of books in the majority of subjects circulate at costs well below the average.

The message is clear: *Circulation of lower priced books is far greater than that of higher priced books.*

SUMMARY OF THE ANALYSES

Expenditure-Enrollment-Circulation Relationships

Subject expenditure is not driven by the size of departments in terms of enrollment or number of faculty. No systematic relationship exists between expenditure and enrollment by subject nor to number of faculty teaching in those subjects. Expenditure per capita averages $34.00, ranging from $100.00 to $7.00, and shows no well defined pattern among subjects.

Expenditure shows an inverse relationship to the average cost of books. Subject expenditure generally increases as the cost of books in those subjects decreases. Subjects in which books are relatively inexpensive generally encumber larger shares of overall expenditure.

Expenditure and circulation by subject show a highly generalized positive relationship. Increasing expenditure generally reflects increased circulation, with major exceptions in business and most areas of the sciences.

The percentage of expenditure by subject and the percentage of circulation by subject relative to overall expenditure and circulation show a fairly positive relationship. Increases in the percentage of expenditure are reflected by increases in the percentage of circulation.

Circulation and enrollment are not related in a uniformly positive manner. However, a definable trend shows that higher circulations tend to be concentrated among the medium sized subjects (departments), with circulation decreasing as department size (enrollment) decreases and increases.

The number of faculty teaching by subject has little or no affect upon circulation by subject.

Circulation by subject shows a positive relationship to the number of new books by subject added to the collection. Business areas and Theater Arts are major exceptions, showing very low circulation; whereas education, medicine, recreation and computer science show very high circulations.

Circulation per capita by subject averages 13.0, ranging from 51 to less than 0.5, and tends to be lower among business and some areas of science.
Per capita expenditure and per capita circulation show a very loose positive relationship.

Gross circulation by subject and average book prices by subject show a surprisingly strong negative reationship, as does circulation per capita and average book prices. By far, the greater majority of circulation occurs among the lower priced books, and correspondingly, among the subjects in which books are relatively inexpensive. Expensive books tend to circulate far less. The same holds true for circulation per capita. Per capita circulation by subject increases as the cost of books by subject decreases. Patrons tend to favor the inexpensive books.

The "cost" of circulation; i.e., the amount of money expended for each book circulated by subject, provides the most tangible measure of the cost of usage. Circulation costs average $4.50, but vary tremendously by subject and range from $25.00 to less than $1.00. The most expensive subjects to circulate fall primarily within the sciences, business, and technology, with the notable inclusion of theater arts. The less expensive subjects include a combination of social sciences, humanities, medicine and computer science.

CONCLUSIONS

Three paramount questions emerge from the interrelationships among the three primary variables: expenditure, enrollment, circulation.

A. Who Uses the Collection?
B. Where are we spending?
C. How can use and spending be equitable?

A. *Who Uses the Collection?*

"Gross Demand" (Overall Circulation)

Greatest Demand	Least Demand
History	Health/Comm Ser
English	Geosciences
Soc/Social Work	Physics
Medicine	Finance/Mkt
Education	Architecture
Economics	Photography
Art	Nursing
Engineering	Chemistry
Communications	Construction Mgm
Psychology	Accounting

"Demand Intensity" (Circulation/Enrollment)

Greatest Demand	Least Demand
History	Geosciences
Religious Studies	Health/Comm
Soc/Social Work	Political Science
Art	Math/Statistics
Economics	Nursing
Engineering	English
Education	Chemistry
Computer Science	Const Mgmt
Anthropology	Finance/Mkt
Recreation Admin	Accounting

B. *Where Are We Spending?*

"Gross Expenditure" (Subject Expenditure)

Greatest Expense	Least Expense
Biology	Physical Education
History	Chemistry
English	Geosciences
Management	Health/Comm Ser
Engineering	Geography
Economics	Recreation Admin
Soc/Social W k	Nursing
Art	Architecture
Psychology	Construction Mgmt
Education	Photography

"Expenditure Intensity" (Expenditure/Enrollment)

Greatest Expense	Least Expense
Theater Arts	English
Art	Physical Educ
Economics	Recreation Ad
History	Accounting
Biology	Finance/Mkt
Engineering	Geography
Physics	Const Mgmt
Religious Studies	Communications
Management	Health/omm Ser
Soc/Social W k	Math/Statistics

"Cost of Circulation" (Expenditure/Circulation)

Most Expensive	Least Expensive
Accounting	Recreation Admin
Chemistry	Medicine
Finance/Mkt	Computer Science
Construction Mgmt	History
Nursing	Religious Studies
Physics	Education
Management	Sociology/Soc Wk
Theater Arts	Communications
Biology	Physical Educ
Math/Statistics	Foreign Lang

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C. *How can use and spending be equitable?*

Demand and expenditure, in gross terms as well as in relative measures of of intensity, are known quantities. What remains unknown, as the analysis of data has shown, is a link whereby expenditure can be adjusted to reflect the demand for books in each subject.

A MODEL FOR SUBJECT ALLOCATION

A method for determining the allocation of expenditure by subject (*subject allocation)* must be both *equitable* and *practical.* It must be equitable in the sense that subjects are given sufficient funding to meet the demand place upon them in terms of *circulation* of books. It must be practical in the sense that the formula, once established, may be monitored and subsequently revised without undue and time consuming diffculty.

A model for subject allocation involves three primary and interacting variables.
Two are open ended: circulation and enrollment.
One is finite: expenditure budget.

Ideally, no artificial constraints are placed upon circulation of materials nor enrollment (although restrictions upon circulation and enrollment caps can be (rarely) applied). The budget for expenditure, however, is closed ended, in that a finite amount is available, generally independent of overall circulation, and usually independent of enrollment in terms of short range planning.

The major objective of an allocation model is to translate the *demand* for books by subject (subject demand) into the *allocation* of sufficient funding to appropriately reflect that demand. Consequently, the finite variable, expenditure, must be applied to two infinite variables, circulation and enrollment.

Circulation, in terms of per capita circulation, combines with enrollment to create *demand.* Demand is thus a product of individual habit as well as gross quantity. Demand, itself, however, proves to be a very elusive component. As the interpretation of data has indicated, demand is not driven by enrollment alone; nor does demand well reflect expenditure, availability of books, or number of faculty. Demand is *subject driven,* and, oddly enough, demand tends to be greatest in subject where books are the least expensive.

The best measure of subject demand is to determine the actual *usage* of materials by subject. The most concrete and practical measure of subject demand is provided by the percentage of overall circulation encumbered by subject. Subject circulation, the product of per capita circulation and enrollment in that subject, taken as a percentage, measures the demand for books in that subject relative to overall demand in all subjects.

The Allocation Model

Subject expenditure, the expenditure allocated by subject, should reflect the *subject demand* (percentage of circulation by that subject). Therefore, the allocation model may be expressed as

$A = E (\%C)$

where: A = subject allocation
E = overall expenditure
C = subject percentage of overall circulation

Rather than engage in the tedious chore of recalculating the subject demand annually, several years of data; e.g., 1990-1995, may be averaged and serve as the *base demand* (Table 4). Assuming that the per capita circulation unique to each subject will remain constant over a period of years, the revisions to the base demand can be annually calculated from changes in enrollment, a component usually readily available. Fortunately, major changes in subject enrollment tend to be gradual; therefore, annual recalculations are rarely necessary. Trends in enrollment need monitoring, and recalculations may prove expedient every 3 to 5 years.

The revised (base) allocations range from 14.1% (History) to 0.1% (Accounting/Management Science) of the overall budget for expenditure (Figure 20). The present allocations are confined to a narrower scale, ranging from 8.2% (Biology) to 0.4% (Photography).

Subject allocations generated from this model differs significantly from present expenditure, with contrasts ranging from plus 237% to minus 93% (Table 5).

Augmentations Exceeding 50%
Recreation Administration
Medicine
History
Computer Science/ Engineering
Religious Studies
Education
Sociology
Communications
Physical Education

Reductions Exceeding 50%
Accounting/Management Science
Finance/Marketing
Contruction Management
Management
Theater Arts
Physics
Nursing
Biology

Augmentations/Reductions Less than 10%
Economics
Psychology
Geography
Photography

Augmentations or reductions ranging from 10 to 50% apply to the remaining subjects.

With the cost of books increasing 50% during the five year time span of this study, and with no end in sight, it becomes most obvious that subject allocations cannot continue to be based upon precepts unsupported by the actual demand for materials. Classical notions of need must give way to practical utilization. Historically, library collection developers "...simply relied on their genuine passion for literature and inbred instinct for what was 'right' when collecting..."[13]. G. Edward Evans' lament that, "Unfortunately, things have not that changed much in 35 years" [14], remains largely true today. These "soft" non-analytical approaches to collection development have positioned academic libraries in the unenviable position of "...at times been called the financial 'black hole,' a unit of campus capable of expending all the resources sent its way, yet remaining with a crucial need for more acquisitions dollars" [15], a roll that libraries can ill-afford to play with the current and increasing emphasis upon accountability.

Universities are now facing a new pragmatism in justifying the expenditure of funds. Academic library funding is no exception. Despite the emergence of a plethora of electronic alternatives to traditional print resources, the library is far from exclusively a "virtual" environment. Libraries will continue to be, in the words of James Billington, Librarian of Congress, "...locations where both the new technologically dispensed information and the old knowledge repositories of books are present in the same place" [16]. Monographs now and into the 21st Century will represent a major encumbrance of funding for library resources.

Library collection developers must embrace a new pragmatism in discriminate funding for monographs. Arbitrary standards for funding levels, inherited from historical allocation decisions and subsequently leveraged by faculty pressures, must give way to quality-based planning, grounded in an assessment of resources in demand by subject [17]. Circulation appears the variable most representative of the true measure of usage (demand) of monographs. Academic libraries should experiment with the allocation model and further explore the utility of circulation as a prime parameter in the allocation by subject of funding for library monographs.

SUBJECT USAGE AND FUNDING OF LIBRARY MONOGRAPHS
A Case Study

III. Figures and Tables

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Table 3. The "Cost" of Circulation.
Table 4. Base Demand and Allocation.
Table 5. Present Expenditure and Revised Allocation.

Figure 1. Expenditure -- Enrollment.

1990-1995 Mean Annual Expenditure and Enrollment (Full Time Equivalent).

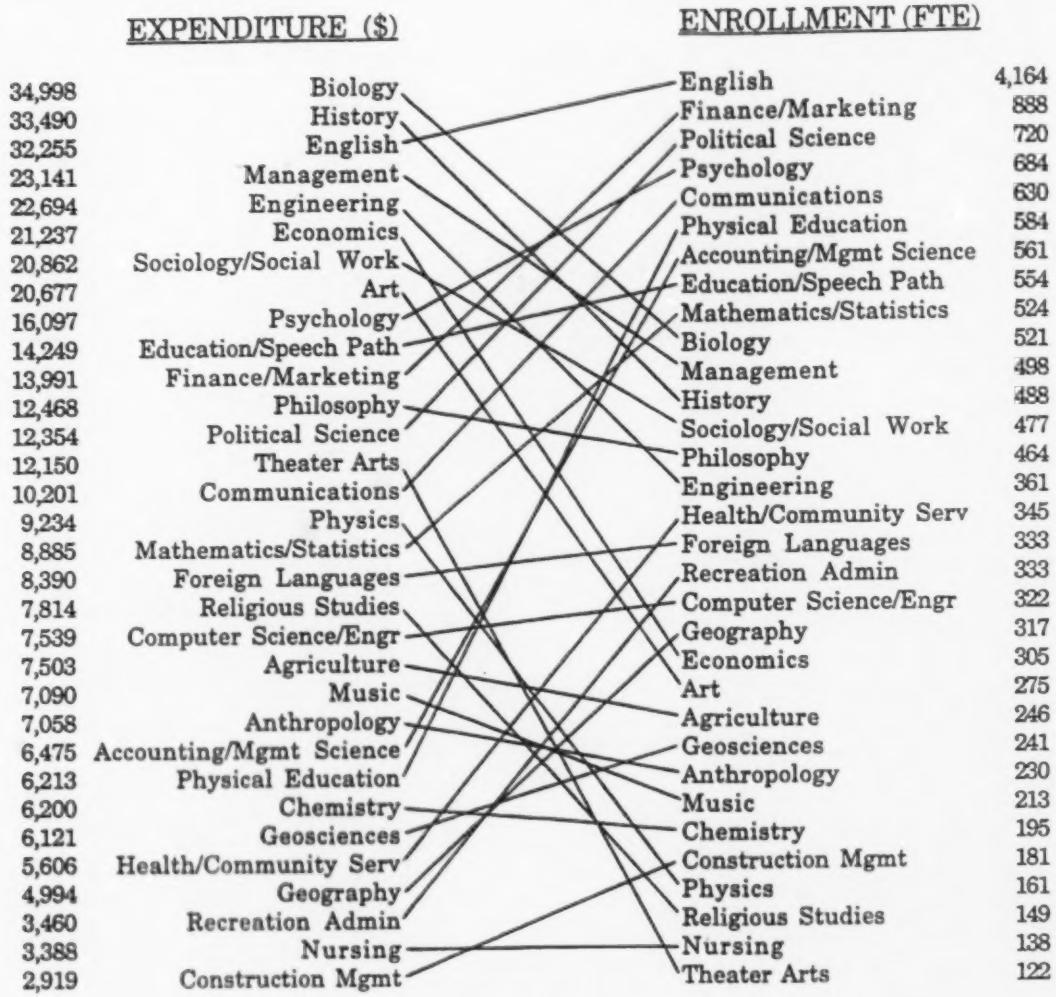

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Figure 2. Expenditure Percentage -- Enrollment Percentage.

1990-1995 Mean Annual Expenditure and Enrollment.

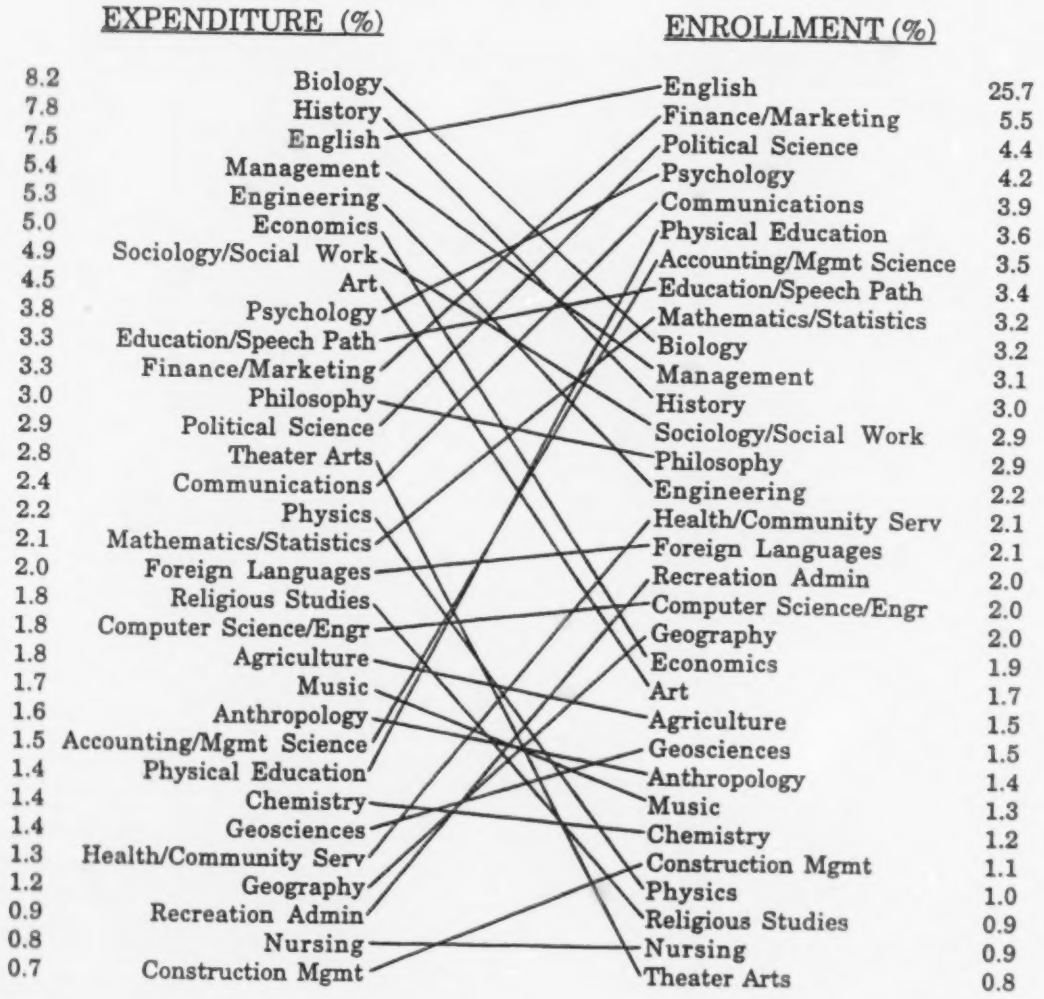

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Figure 3. Expenditure--Faculty Number.

1990-1995 Mean Annual Expenditure and Faculty Number (Full Time Equivalent).

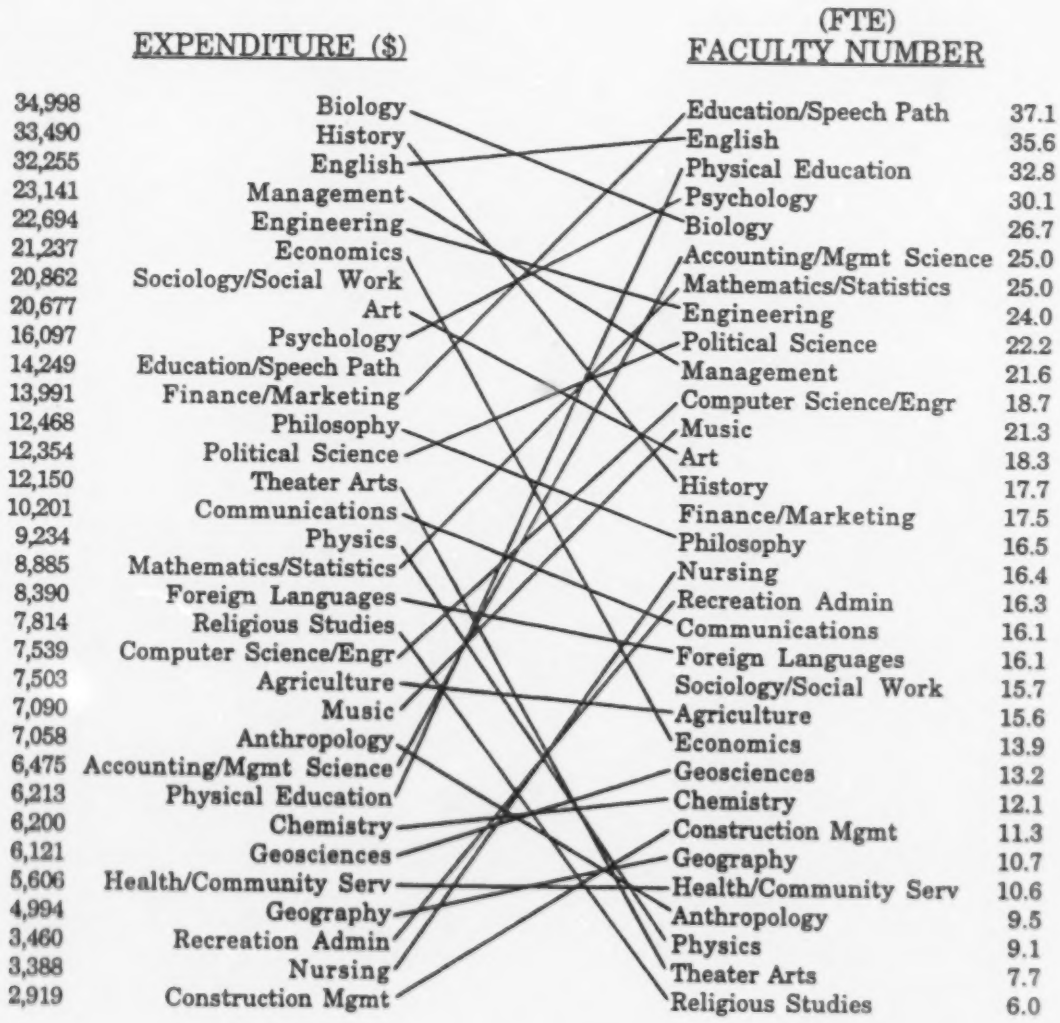

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Figure 4. Expenditure--Book Price.

1990-1995 Mean Annual Expenditure and Book Prices.

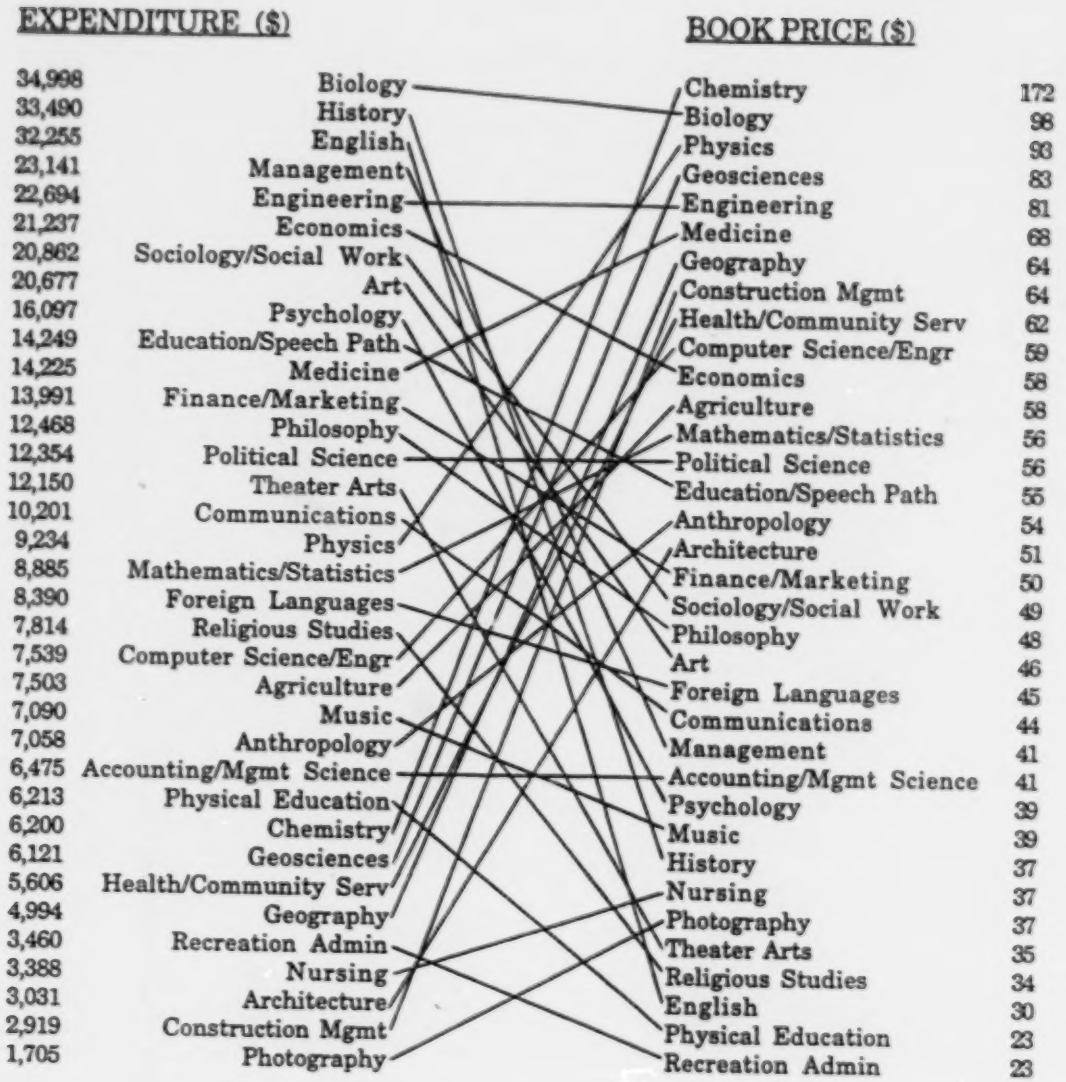

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Figure 5. Expenditure--Circulation.

1990-1995 Mean Annual Expenditure and Circulation.

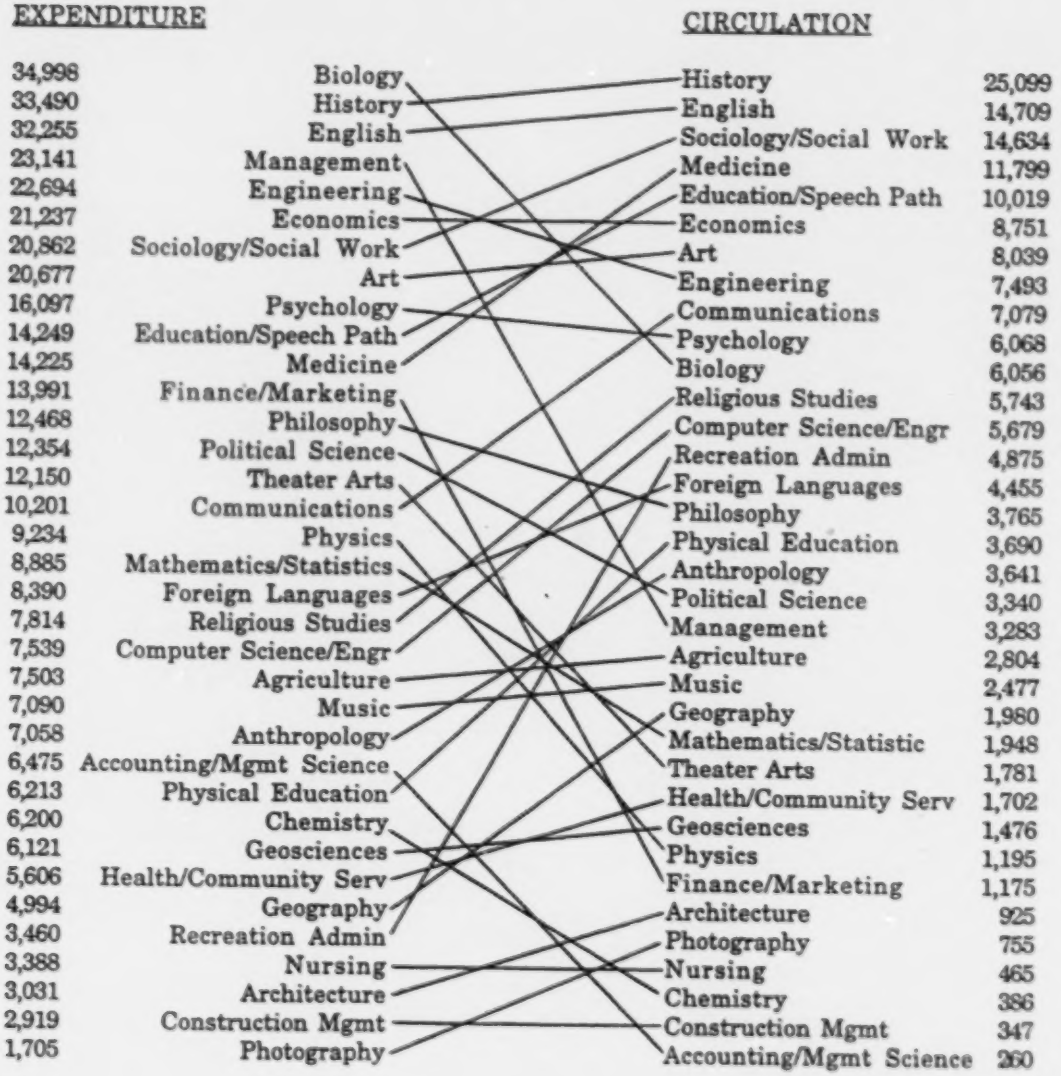

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Figure 6. Expenditure–Circulation.

1990-1995 Mean Annual Expenditure and Circulation.

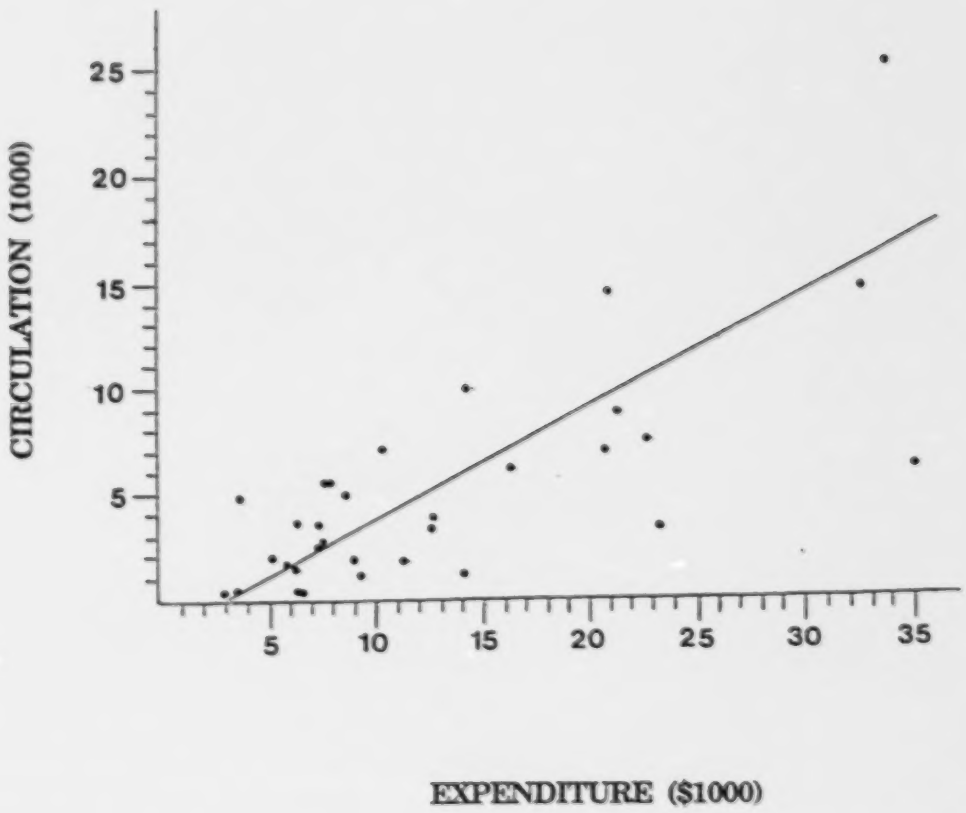

Figure 7. Enrollment--Circulation.

1990-1995 Mean Annual Circulation and Enrollment (Full Time Equivalent).

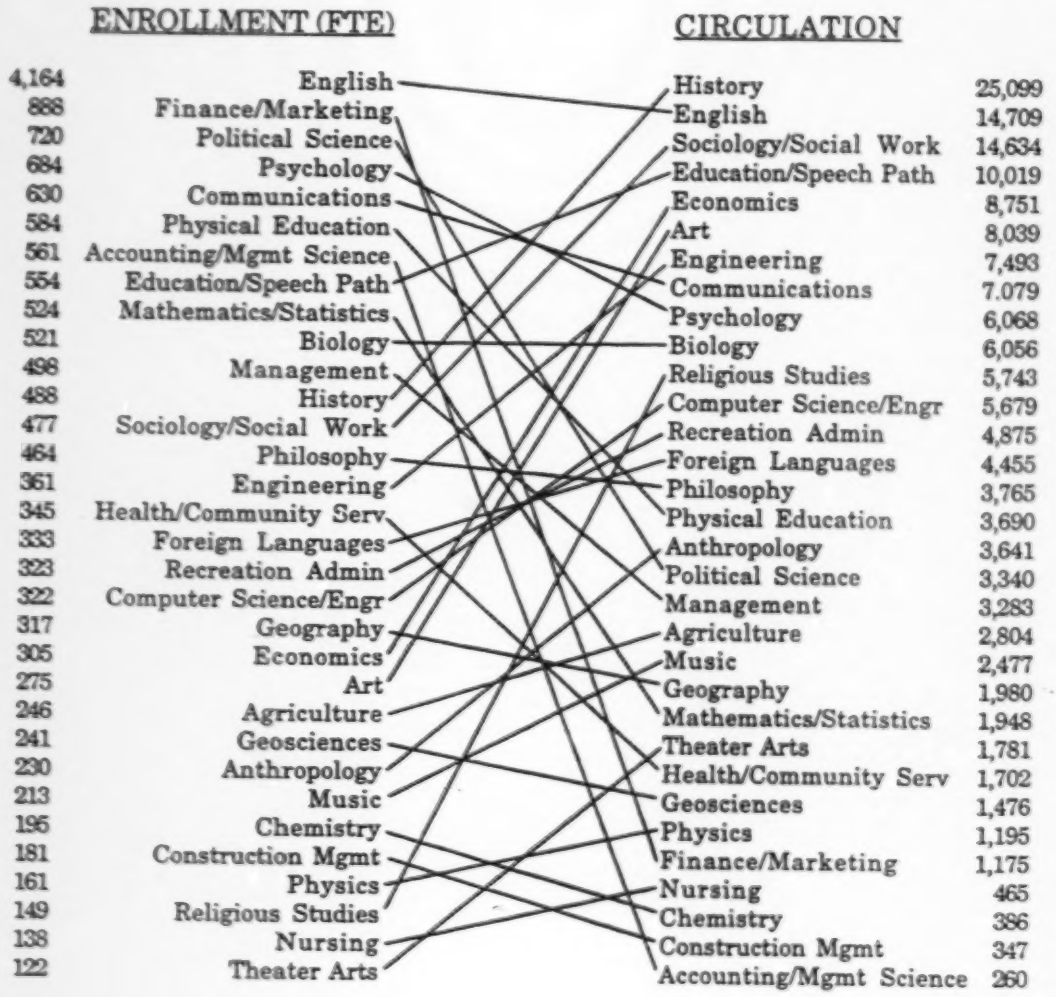

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Figure 8. The Relationship of Enrollment to Circulation.

1990-1995 Mean Annual Enrollment (Full Time Equivalent) and Circulation by Subject.

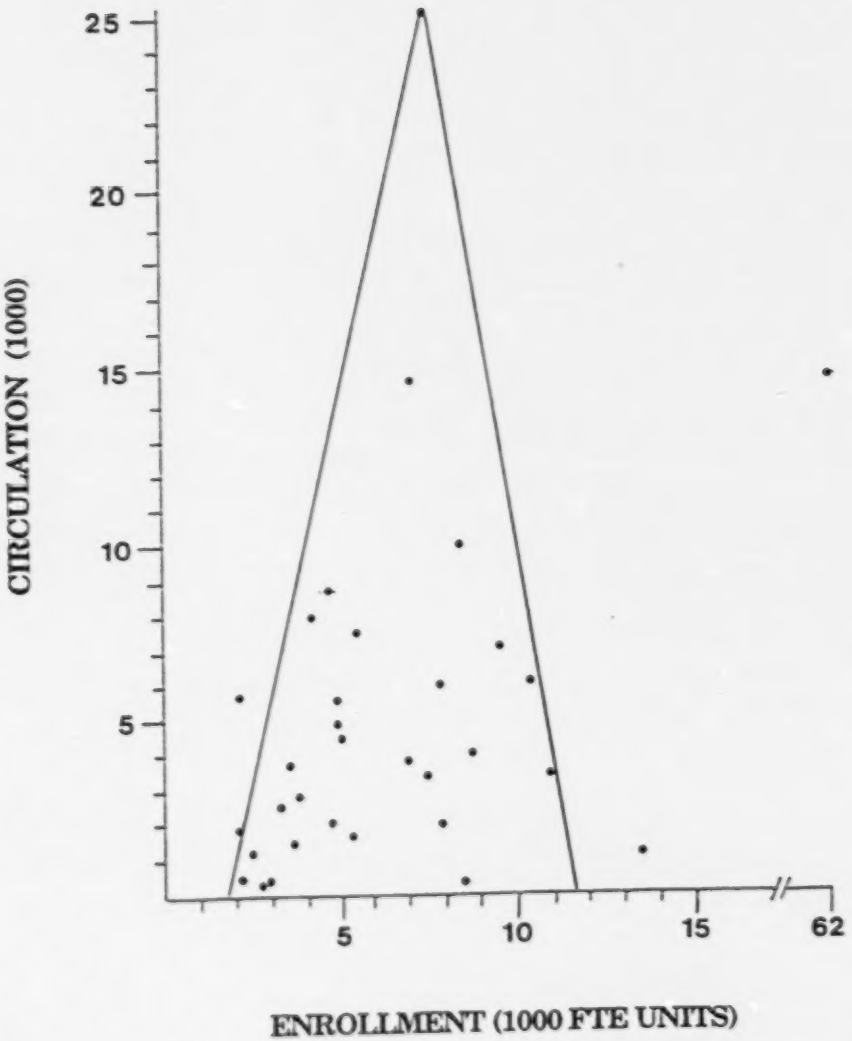

Figure 9. Faculty -- Circulation.

1990-1995 Mean Annual Faculty (Full Time Equivalent) and Circulation.

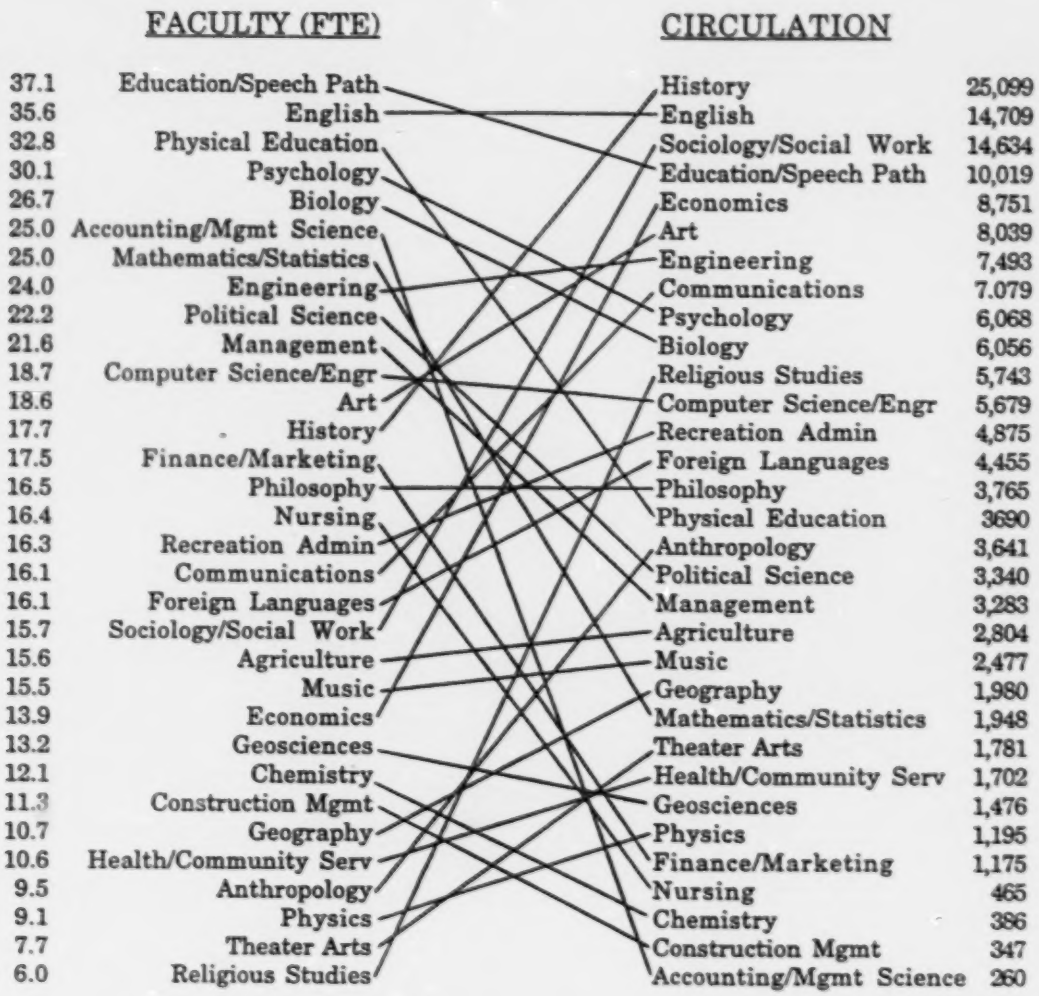

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Figure 10. Expenditure -- Circulation Per Capita.

1990-1995 Mean Annual Expenditure and Circulation.

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Figure 11. Expenditure Per Capita -- Circulation Per Capita.

"Dollars Per Student" -- "Books Per Student"

1990-1995 Mean Annual Expenditure, Circulation, Enrollment.

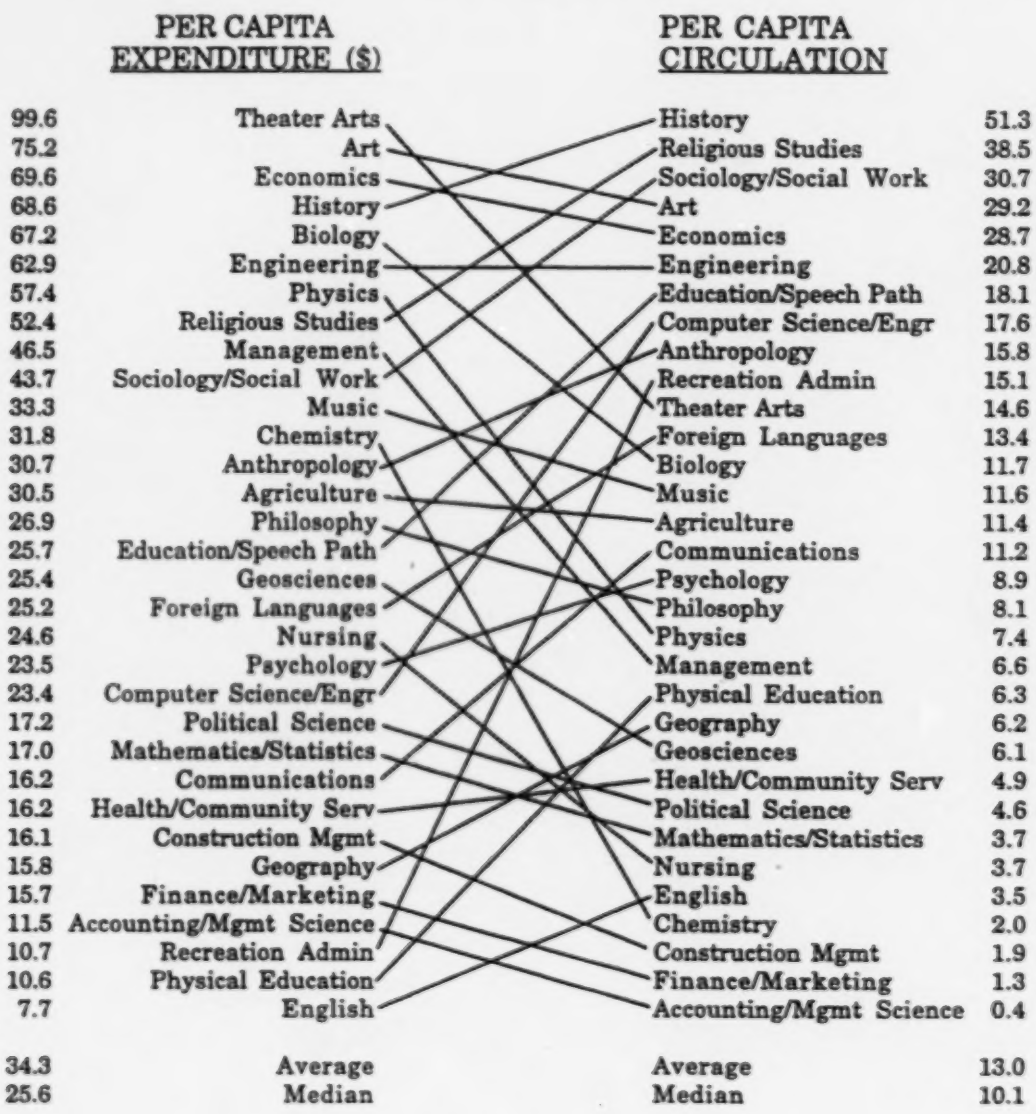

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Figure 12. Expenditure Percentage -- Circulation Percentage.

1990-1995 Mean Annual Expenditure and Circulation.

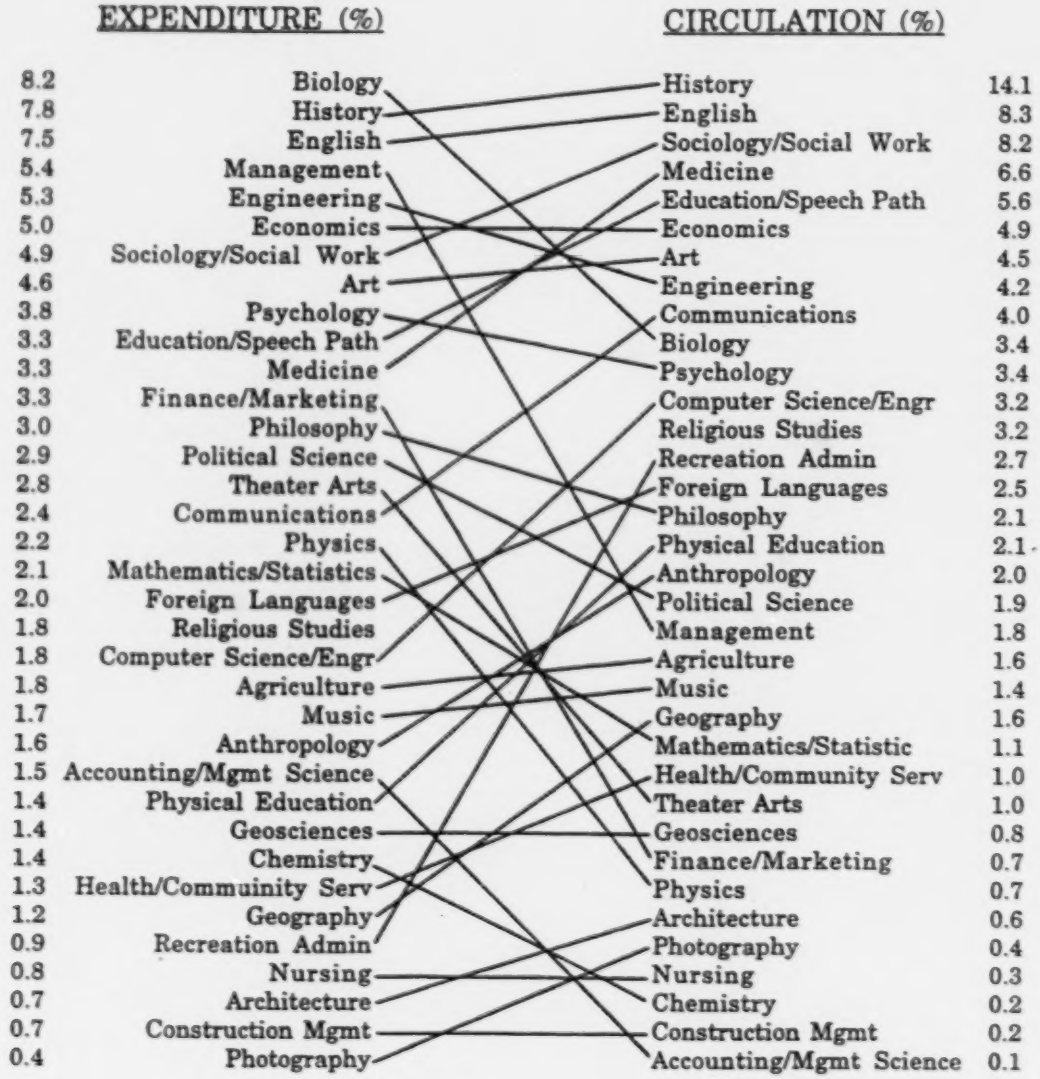

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Figure 13. The Relationship of Expenditure Percentage to Circulation Percentage by Subject.

1990-1995 Mean Annual Expenditure and Circulation.

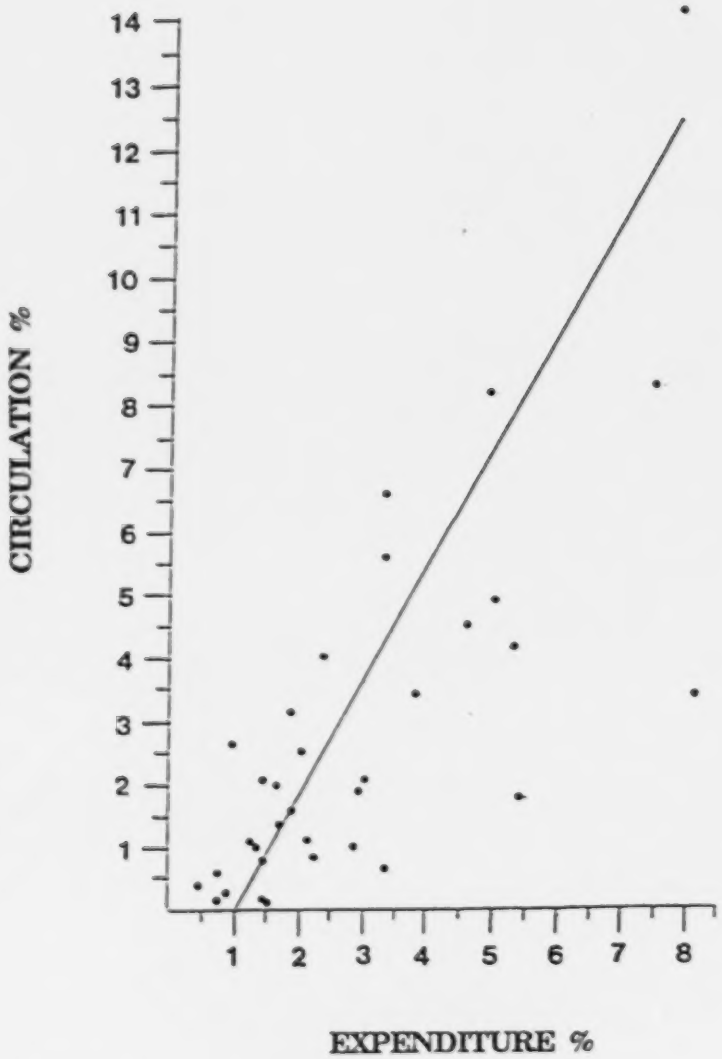

Figure 14. Enrollment Percentage -- Circulation Percentage.

1990 - 1995 Mean Annual Enrollment and Circulation.

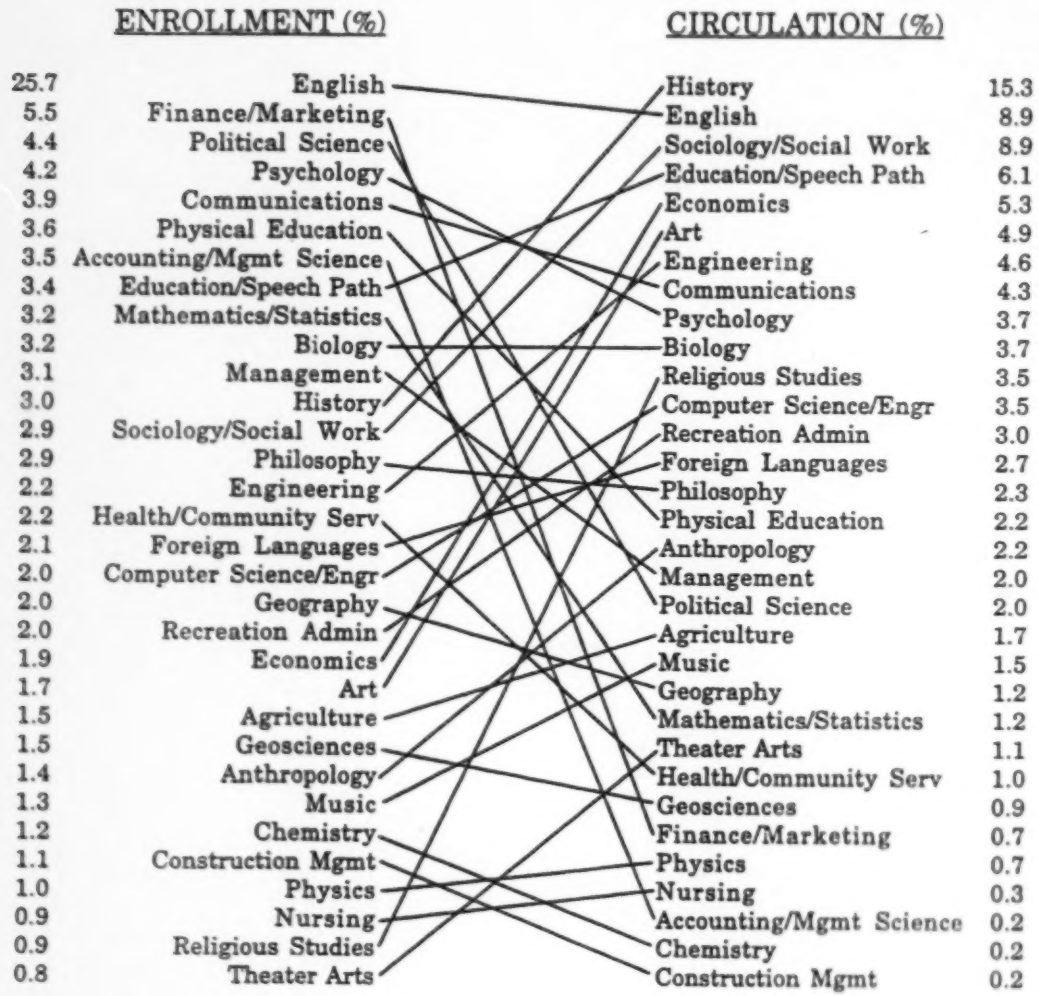

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Figure 15. New Books -- Circulation.

1990-1995 Mean Annual New Books Received and Circulation.

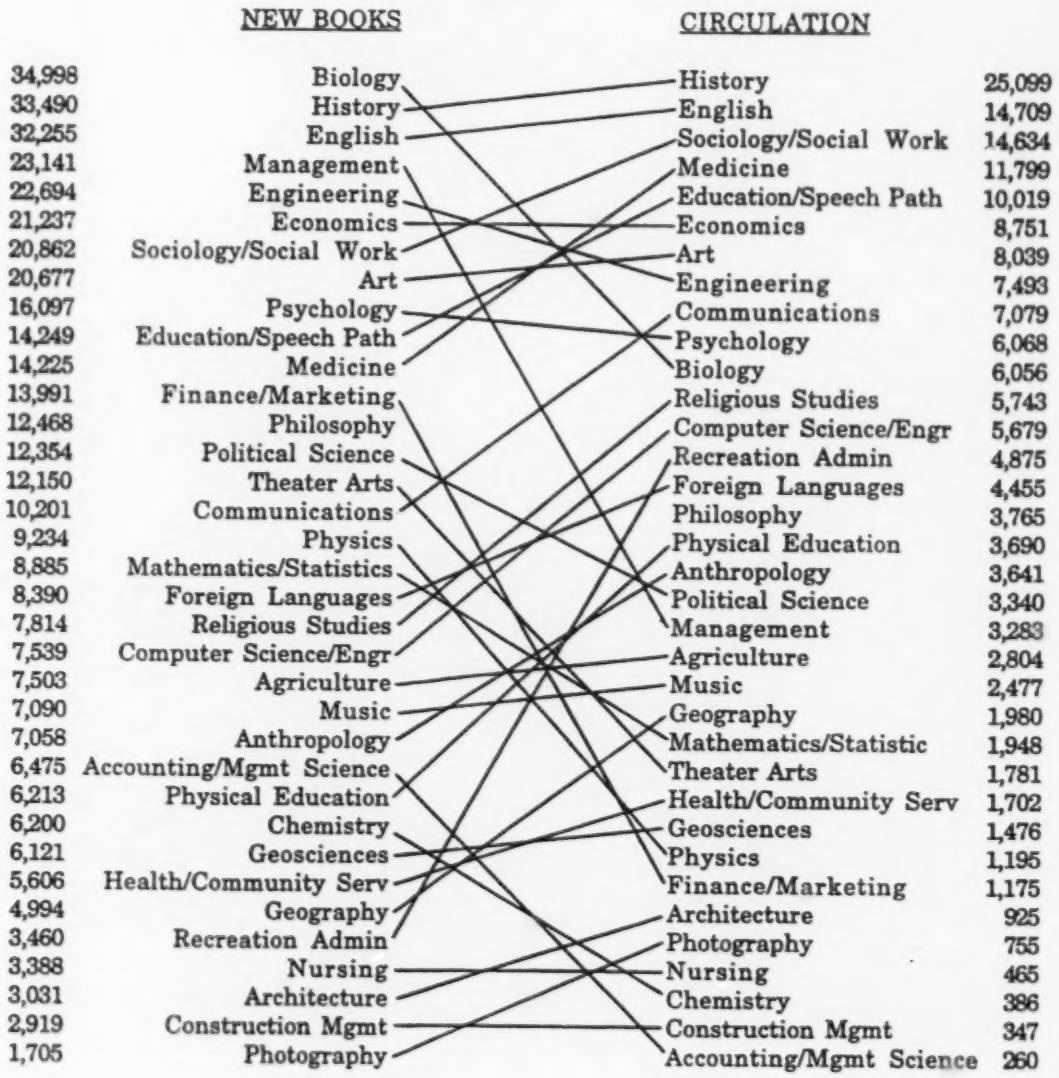

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Figure 16. The Relationship of New Books Received to Circulation.

1990-1995 Mean Annual New Books Received and Circulation by Subject.

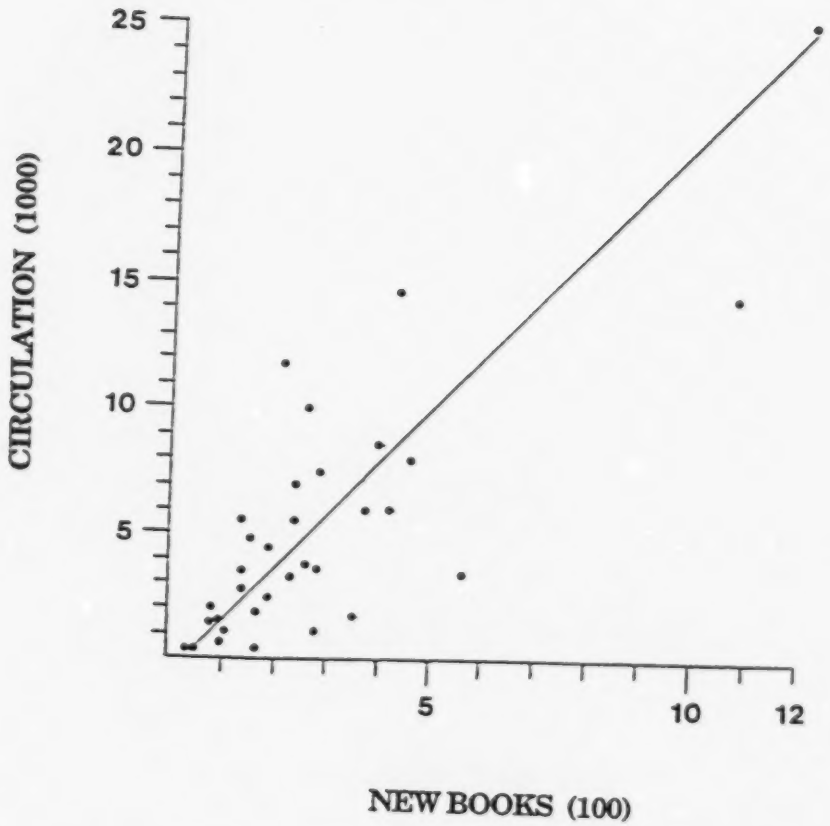

Figure 17. Book Price -- Circulation.

1990 - 1995 Mean Annual New Book Prices and Circulation.

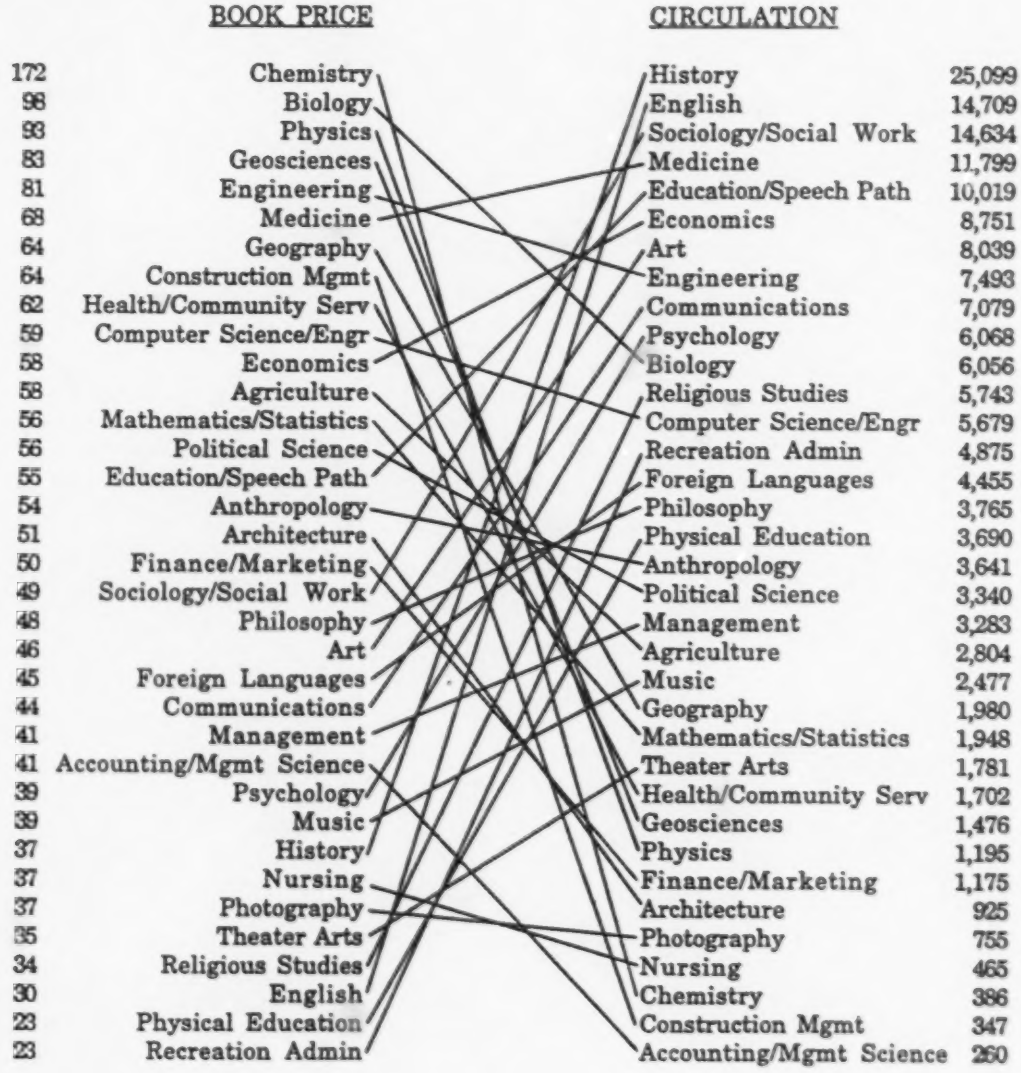

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Figure 18. The Relationship of Book Prices to Circulation.

1990-1995 Mean Annual New Book Prices and Circulation by Subject.

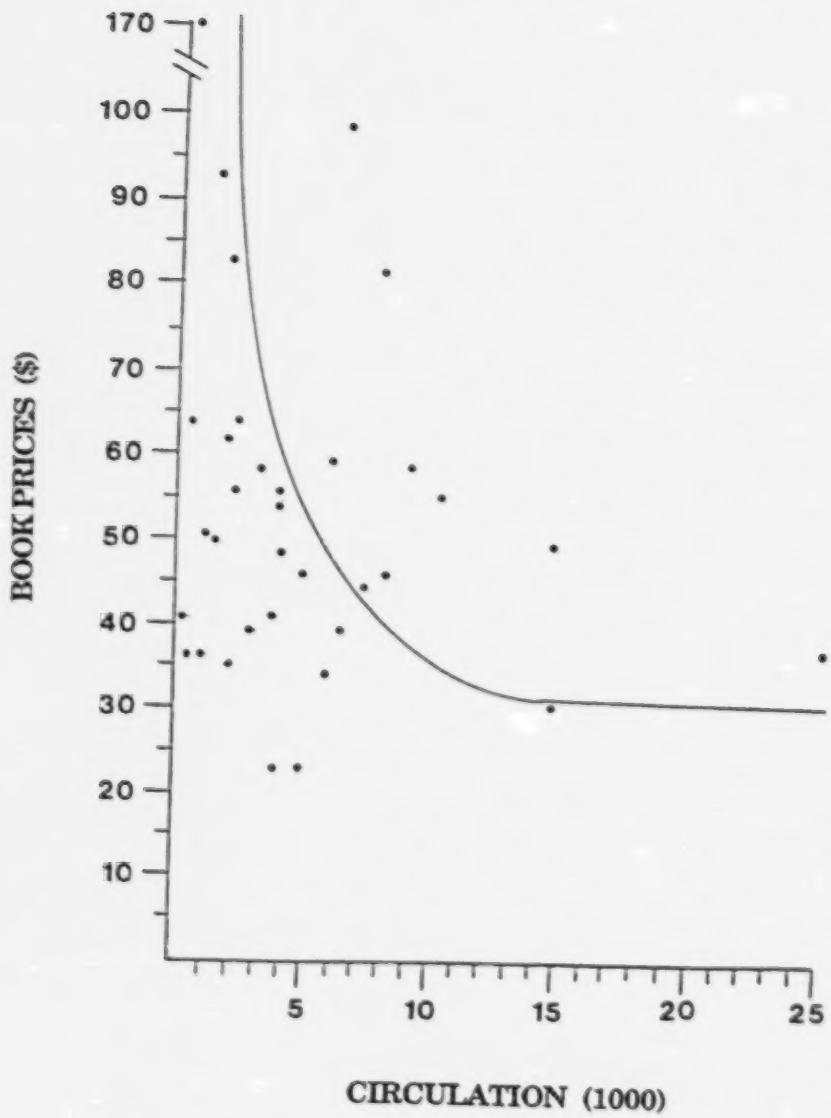

Figure 19. Book Price -- Circulation Per Capita.

1990 - 1995 Mean Annual New Book Prices and Circulation.

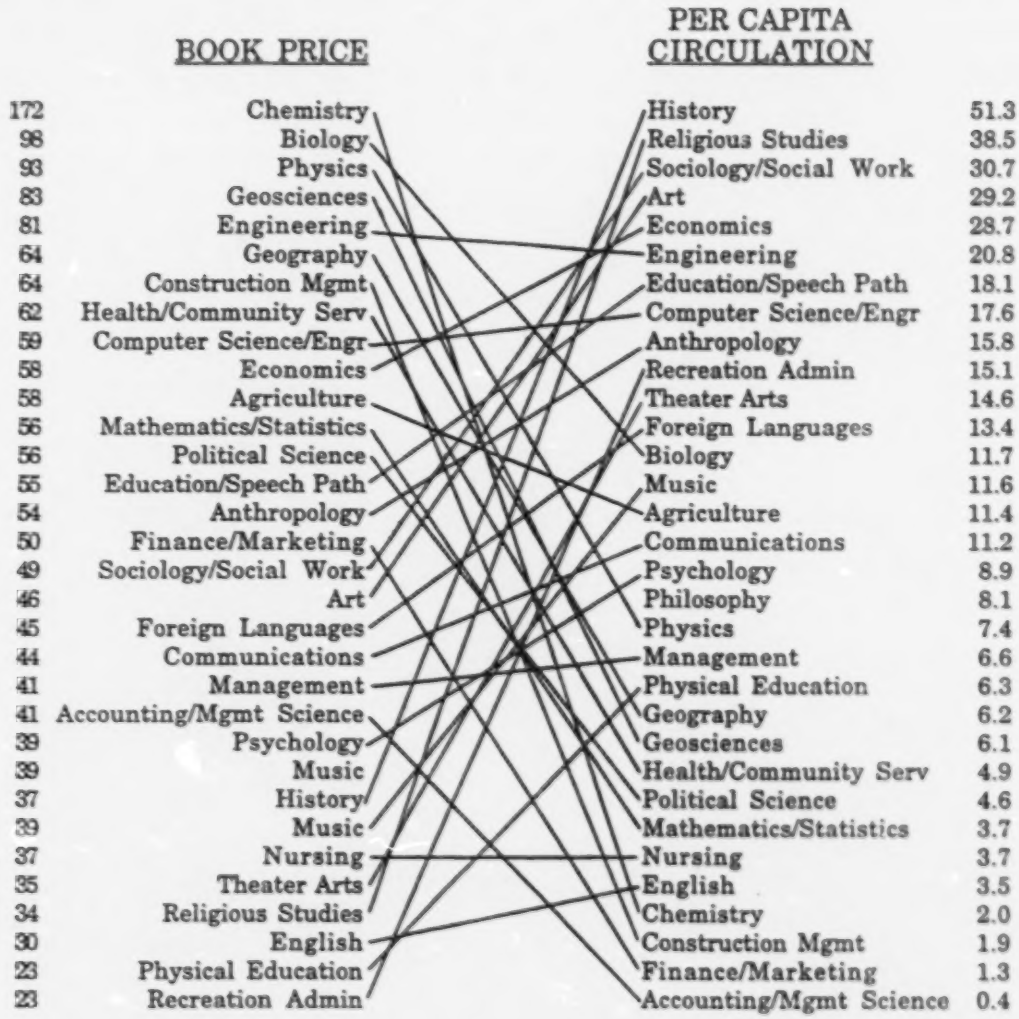

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Figure 20. Present Expenditure and Revised Allocation.

(%) PRESENT EXPENDITURE	
8.2	Biology
7.8	History
7.5	English
5.4	Management
5.3	Engineering
5.0	Economics
4.9	Sociology/Social Work
4.6	Art
3.8	Psychology
3.3	Education/Speech Path
3.3	Medicine
3.3	Finance/Marketing
3.0	Philosophy
2.9	Political Science
2.8	Theater Arts
2.4	Communications
2.2	Physics
2.1	Mathematics/Statistics
2.0	Foreign Languages
1.8	Religious Studies
1.8	Computer Science/Engr
1.8	Agriculture
1.7	Music
1.6	Anthropology
1.5	Accounting/Mgmt Science
1.4	Physical Education
1.4	Geosciences
1.4	Chemistry
1.3	Health/Community Serv
1.2	Geography
0.9	Recreation Admin
0.8	Nursing
0.7	Architecture
0.7	Construction Mgmt
0.4	Photography

(%) REVISED ALLOCATION	
History	14.1
English	8.3
Sociology/Social Work	8.2
Medicine	6.6
Education/Speech Path	5.6
Economics	4.9
Art	4.5
Engineering	4.2
Communications	4.0
Biology	3.4
Psychology	3.4
Computer Science/Engr	3.2
Religious Studies	3.2
Recreation Admin	2.7
Foreign Languages	2.5
Philosophy	2.1
Physical Education	2.1
Anthropology	2.0
Political Science	1.9
Management	1.8
Agriculture	1.6
Music	1.4
Geography	1.6
Mathematics/Statistics	1.1
Health/Community Serv	1.0
Theater Arts	1.0
Geosciences	0.8
Finance/Marketing	0.7
Physics	0.7
Architecture	0.6
Photography	0.4
Nursing	0.3
Chemistry	0.2
Construction Mgmt	0.2
Accounting/Mgmt Science	0.1

Table 1. Circulation Per Student.

1990-1995 Mean Annual Enrollment and Circulation.

Subject	Enrollment	Circulation	PER CAPITA CIRCULATION
History	488	25,099	51.43
Religious Studies	149	5,743	38.5
Sociology/Social Work	477	14,634	30.7
Art	275	8,039	29.2
Economics	305	8,751	28.7
Engineering	361	7,493	20.8
Education/Speech Pathology	554	10,019	18.1
Computer Science/Engr	322	5,679	17.6
Anthropology	230	3,641	15.8
Recreation Admin	323	4,875	15.1
Theater Arts	122	1,781	14.6
Foreign Languages	333	4,455	13.4
Biology	521	6,056	11.7
Music	213	2,477	11.6
Agriculture	246	2,804	11.4
Communications	630	7,079	11.2
Psychology	684	6,068	8.9
Philosophy	464	3,765	8.1
Physics	161	1,195	7.4
Management	498	3,283	6.6
Physical Education	584	3,690	6.3
Geography	317	1,980	6.2
Geosciences	241	1,476	6.1
Health/Community Services	345	1,702	4.9
Political Science	720	3,340	4.6
Mathematics/Statistics	524	1,948	3.7
Nursing	138	465	3.7
English	4,164	14,709	3.5
Chemistry	195	386	2.0
Construction Mgmt	181	347	1.9
Finance/Marketing	888	1,175	1.3
Accounting/Mgmt Science	561	260	0.4
		Average	**13.0**
		Median	**10.1**

Table 2. Ratio of Expenditure to Circulation.

1990-1995 Mean Annual Expenditure and Circulation.

Department	% Expenditure	% Circulation	Circulation/ Expenditure
Recreation Administration	0.9	2.7	3.0
Medicine	3.3	6.6	2.0
Computer Science/Engineering	1.8	3.2	1.8
History	7.8	14.1	1.8
Religious Studies	1.8	3.2	1.8
Communications	2.4	4.0	1.7
Education/Speech Pathology	3.3	5.6	1.7
Sociology/Social Work	4.9	8.2	1.7
Physical Education	1.4	2.1	1.5
Anthropology	1.6	2.0	1.3
Foreign Languages	2.0	2.5	1.3
English	7.5	8.3	1.1
Economics	5.0	4.9	1.0
Art	4.6	4.5	1.0
Photography	0.4	0.4	1.0
Agriculture	1.8	1.6	0.9
Architecture	0.7	0.6	0.9
Geography	1.2	1.1	0.9
Psychology	3.8	3.4	0.9
Engineering	5.3	4.2	0.8
Health/Community Services	1.3	1.0	0.8
Music	1.7	1.4	0.8
Philosophy	3.0	2.1	0.7
Political Science	2.9	1.9	0.7
Geosciences	1.4	0.8	0.6
Mathematics/Statistics	2.1	1.1	0.5
Biology	8.2	3.4	0.4
Nursing	0.8	0.3	0.4
Theater Arts	2.8	1.0	0.4
Physics	2.2	0.8	0.4
Construction Management	0.7	0.2	0.3
Management	5.4	1.8	0.3
Finance/Marketing	3.3	0.7	0.2
Accounting/Management Science	1.5	0.1	0.1
Chemistry	1.4	0.2	0.1
		Average	**1.0**

Table 3. The "Cost" of Circulation.

1990-1991 Mean Annual Expenditure and Circulation by Subect.

Subject	Expenditure	Circulation	Dollars/ Book	Books/ Dollar
Recreation Admin	3,460	4,875	0.71	1.41
Medicine	14,225	11,799	1.21	0.83
Computer Science/Engr	7,539	5,679	1.33	0.75
History	33,490	25,099	1.33	0.75
Religious Studies	7,814	5,743	1.36	0.73
Education/Speech Path	14,249	10,019	1.42	0.82
Sociology/Social Work	20,862	14,634	1.43	0.70
Communications	10,201	7,079	1.44	0.69
Physical Education	6,213	3,690	1.68	0.59
Foreign Languages	8,390	4,455	1.88	0.53
Anthropology	7,058	3,641	1.94	0.52
English	32,255	14,709	2.19	0.46
Photography	1,705	755	2.25	0.44
Economics	21,237	8,751	2.43	0.41
Geography	4,994	1,980	2.52	0.40
Art	20,677	8,039	2.57	0.39
Psychology	16,097	6,068	2.66	0.38
Agriculture	7,503	2804	2.68	0.37
Music	7,090	2,477	2.86	0.35
Engineering	22,694	7,493	3.03	0.33
Architecture	3,031	925	3.28	0.31
Health/Community Serv	5,606	1,702	3.29	0.30
Philosophy	12,468	3,765	3.31	0.30
Political Science	12,354	3,340	3.70	0.27
Geosciences	6,121	1,476	4.15	0.24
Mathematics/Statistics	8,885	1,948	4.56	0.22
Biology	34,998	6,056	5.78	0.17
Theater Arts	12,150	1,781	6.82	0.15
Management	23,141	3,283	7.05	0.14
Physics	9,234	1,195	7.73	0.13
Nursing	3,388	465	7.29	0.14
Construction Mgmt	2,919	347	8.41	0.12
Finance/Marketing	13,981	1,175	11.90	0.08
Chemistry	6,200	386	16.06	0.06
Accounting/Mgmt Science	6,475	260	24.90	0.04
			Mean 4.49	**0.41**
			Median 2.67	**0.38**

Table 4. Base Demand and Allocation.

1990-1995 Mean Annual: Expenditure and Circulation.

Subject	Base Demand (%)	Allocation ($)
History	14.1	60,870
English	8.3	35,831
Sociology/Social Work	8.2	35,400
Medicine	6.6	28,492
Education/Speech Pathology	5.6	24,175
Economics	4.9	21,153
Art	4.5	19,427
Engineering	4.2	18,131
Communications	4.0	17,268
Biology	3.4	14,678
Psychology	3.4	14,678
Religious Studies	3.2	13,814
Computer Science/Engr	3.2	13,814
Recreation Admin	2.7	11,656
Foreign Languages	2.5	10,793
Philosophy	2.1	9,066
Physical Education	2.1	9,066
Anthropology	2.0	8,634
Political Science	1.9	8,202
Management	1.8	7,771
Agriculture	1.6	6,907
Music	1.4	6,044
Mathematics/Statistics	1.1	4,749
Geography	1.1	4,749
Theater Arts	1.0	4,317
Health/Community Services	1.0	4,317
Physics	0.8	3,454
Geosciences	0.8	3,454
Finance/Marketing	0.7	3,022
Architecture	0.6	2,590
Photography	0.4	1,727
Nursing	0.3	1,295
Chemistry	0.2	863
Construction Mgmt	0.2	863
Accounting/Mgmt Science	0.1	432
		Total 431,702

Table 5. Present Expenditure and Revised Allocation.

1990-1995 Mean Annual Expenditure and Circulation.

Subject	Present Expenditure Dollars	%	Revised Allocation Dollars	%	% Change
Biology	34,998	8.2	14,678	3.4	-142
History	33,490	7.8	60,870	14.1	+82
English	32,255	7.5	35,831	8.3	+10
Management	23,141	5.4	7,771	1.8	-66
Engineering	22,694	5.3	18,131	4.2	-20
Economics	21,237	5.0	21,153	4.9	0
Sociology/Social Work	20,862	4.9	35,400	8.2	+70
Art	20,677	4.6	19,427	4.5	-0.2
Psychology	19,097	3.8	14,678	3.4	-10
Education/Speech Path	14,247	3.3	24,175	5.6	+69
Medicine	14,225	3.3	28,492	6.6	+100
Finance/Marketing	13,981	3.3	3,022	0.7	-78
Philosophy	12,468	3.0	9,066	2.1	-27
Political Science	12,354	2.9	8,202	1.9	-34
Theater Arts	12,150	2.8	4,317	1.0	-64
Communications	10,201	2.4	17,268	4.0	+69
Physics	9,234	2.2	3,454	0.8	-63
Mathematics/Statistics	8,885	2.1	4,749	1.1	-47
Foreign Languages	8,390	2.0	10,793	2.5	+29
Religious Studies	7,814	1.8	13,814	3.2	+77
Computer Science/Engr	7,539	1.8	13,814	3.2	+83
Agriculture	7,503	1.8	6,907	1.6	-8
Music	7,090	1.7	6,044	1.4	-15
Accounting/Mgmt Science	6,475	1.5	432	0.1	-93
Anthropology	7,058	1.6	8,634	2.0	+22
Physical Education	6,213	1.4	9,066	2.1	+50
Chemistry	6,200	1.4	863	0.2	-86
Geosciences	6,121	1.4	3,454	0.8	-44
Health/Community Serv	5,606	1.3	4,317	1.0	-23
Geography	4,994	1.2	4,749	1.1	-5
Recreation Admin	3,460	0.9	11,656	2.7	+237
Nursing	3,388	0.8	1,276	0.3	-62
Architecture	3,031	0.7	1,295	0.6	-57
Construction Mgmt	2,919	0.7	863	0.2	-70
Photography	1,705	0.4	1,727	0.4	-1
Total	431,702		431,702		

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IV. References